SYNTAX ZX80®

A PUBLICATION OF **THE HARVARD GROUP**

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SINCLAIR NEWS

Sinclair has sold out their non-working ZX80 PCBs. The offer is no longer available.

No news on the ZX printer--still in FCC.

If you can't load a copy of Sinclair's cassette #3, business/household, you may have the wrong tape. Several readers report that #3 is really #5, games. To check yours, type LOAD "" to load the first program and see what it is. Sinclair knows about this problem and is checking it with the manufacturer in England. Right now, just return mismarked tapes to Sinclair.

UK SOFTWARE/HARDWARE IMPORTED BY MINDWARE

British hardware and software producers are way ahead of US producers because the ZX81 has sold in the UK for over a year. Mindware Co. just announced exclusive distribution deals with UK authors and developers. Catalog (includes business, engineering, utility and game software, and various hardware) free from Mindware Co., 70 Boston Post Rd, Wayland, MA 01778, 617/358-7175.

MODEM, MEMORY FROM BYTE-BACK WITH DELAYS

Byte-Back, Leesville, SC, offers ZX81 modems plus RS-232 (kit $99.95), 16K memory modules (kit $69.95) and control modules (kit $59) and expects to sell 48K RAM boards (kit $179) in 6 weeks. Assembled and tested units are $10 more. Brent Minchey of Byte-Back says deliveries are delayed, modems till the end of April and memories till mid-April. Due to a change in chip design, memories now come with 4516, 4517 or 2118 memory chips with external refresh circuitry. The modem will NOT work with ZX80s because it uses the SLOW mode, though Brent says it should work with a video upgrade board (not tested). Byte-Back, Rt. 3 Bx 147, Brodie Rd., Leesville, SC 29070.

SYNTAX ERRORS: Clifford Efaw of Morton, WA, corrected his change for 8K Blackjack (4K version in Jan.82):

```
 370 LET X=INT (RND*52)+1
```

K.B. Duda of Northlake, IL, also noted that line 330 should read GOTO 10, not GOTO 40.

Line 90 in Leo Morgan's Hex Math for 8K, Mar.82, should read:

```
  90 DIM N(2)
```

Jon Bobst's article on the Flags Register (Mar.82) contained an error. JR Z e means Jump Relative "e" if the Z flag is set (=1) where "e" is the offset number of bytes/addresses.

Lane Lester's Income Tax program (Mar.82) had a few errors:

```
 170 GOTO 100
1120 RETURN
4060 RETURN
7199 REM SCHEDULE A (inverse)
```

VIDEO ARTIST MODIFICATION

William Wentz of Rio Rancho, NM, sent this version of Lance Ward's 8K Video Artist program (Mar.82). His mod 1. compresses the program to 1K by using as many common integers as possible and replacing by a simple variable, 2. eliminates redundancy of lines 110-149, giving a flashing cursor for both Plot and Unplot, 3. uses ABS function in lines 50 & 60 to prevent plotting reversal, 4. adds lines 120 & 130 to prevent error B when plotting beyond range (limit 40 in line 120 is for 1K; increase to 63 for larger memory; limit in line 130 prevents overrun of title, and 5. titles the picture (limit to 10 characters on 1K machines).

```
   5 LET A=1
  10 LET X=A
  12 LET Y=A
  13 LET P=A
  15 PRINT "ENTER TITLE"
  20 INPUT A$
  25 CLS
  27 PRINT A$
  30 PLOT X,Y
  40 UNPLOT X,Y
  45 IF P=A THEN PLOT X,Y
  50 IF INKEY$="5" THEN LET X=AB
S (X-A)
  60 IF INKEY$="6" THEN LET Y=AB
S (Y-A)
  70 IF INKEY$="7" THEN LET Y=Y+
A
  80 IF INKEY$="8" THEN LET X=X+
A
  90 IF INKEY$="0" THEN LET P=0
 100 IF INKEY$="1" THEN LET P=A
 110 IF INKEY$="S" THEN SAVE A$
 120 IF X>40 THEN LET X=X-A
 130 IF Y>41 THEN LET Y=Y-A
 140 GOTO 30
SYNTACTIC SUM:   19972. 8K
```

NEW PUBLICATION

The S & S Company will publish SYNCHRO-SETTE, a magazine and bi-monthly cassette publication for ZX81s and 8K ZX80s. The magazine will cover news and programming; the cassette will provide at least six taped programs including games, educational, business, finance and sports. One year subscription is $39.50. S & S Company, 388 W. Lake St., Addison, IL 60101, 312/628-8955 or toll-free 800/543-1300, 800/582-1364 in Ohio.

34 COLUMNS--8K

This 8K program lets you type in text 34 columns by 22 lines and fits in 2K RAM. Enter the program, then SAVE it immediately (computer sometimes crashes upon exiting).

RUN and type in text (you won't get an input prompt L). Use shift 1 to space and shift 0 to backspace. Hit ENTER (or NEWLINE) to go to the next line.

Depending on the screen border, the 34th column may or may not entirely show. Do not type in multiple character keywords (STOP, LLIST, etc.). This idea can be used for other applications.

Mark Freitas, Chelsea, MI

```
   1 FOR I=1 TO 747
   2 PAUSE 900
   3 LET A$=INKEY$
   4 IF CODE A$=117 THEN LET A$=
" "
   5 IF CODE A$=119 THEN LET I=I
-1
   6 IF CODE A$=119 THEN LET A$=
""
   7 IF A$="" THEN GOTO 2
   8 POKE (PEEK 16396+256*PEEK 1
6397)+I,CODE A$
   9 NEXT I
SYNTACTIC SUM:   12453. 8K
```

NUMBERS HELD INEXACTLY IN THE ZX81

(Part 2 of Dr. O'Hara's article on the ZX81's number handling.--AZ)

Positive Integral Powers of 10

We started with powers of 2 in part 1 (Mar.82) because that's how the computer works. But powers of 10 are even more important in practice. Happily, all powers of 10 from 10, 100, ...10,000,000,000,000 (with 13 zeros) are held exactly on the ZX81. The same is true of 1E1, 1E2, 1E3...1E13. A bit is lost for the first time from 1E14. This is very useful for accurate work in BASIC. But 10**1, 10**2 etc. are slightly inaccurate--don't use them if you can easily avoid them.

Run Program 1 (from Mar.82):

```
 10 INPUT X
 20 LET V=PEEK 16400+256*PEEK 1
6401
 30 FOR I=V+1 TO V+5
 40 PRINT PEEK I;" ";
 50 NEXT I
 60 PRINT
 70 GOTO 10
```

Input 10. You'll get 132 32 0 0 0. This is because 10 is held as 16 times (5/8), ie, as the 4th power of 2 times the binary decimal .101 (in 4 bytes, 160 0 0 0). Remembering that 128 is added to the 4 (the exponent byte) and that 128 is taken off the 160 for a positive number, we get 132 32 0 0 0. (Once again the manual may help here.) Then 1E2 gives 135 72 0 0 0, and 1E13 gives 172 17 132 213 42.

To check the accuracy of these powers of 10, multiply successively by 10/8 or 10/16 as the exponent byte changes by 3 or 4. It is a bit awkward, because you have to keep reducing mod 256, but patience will be rewarded.

Note that the fact that 1013 is held exactly has nothing to do with the fact that the ZX81 prints up to 13 digits; in general, only the first 8 are accurate.

Frank O'Hara, Surbiton, Surrey, UK

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SIDE-SCROLLING BILLBOARD--8K

This program scrolls a message across the screen using 8x8 big characters. It decodes only the first 63 characters of the character generator (refer to ZX81 manual, pp.181-2). You'll need more than 1K RAM.

Follow steps 1-4 to enter the program. Step 1 reserves about 1000 bytes for your message. This can be changed. When entering the code in step 3, I suggest entering 8 bytes at a time and then double-checking your entries.

To use the finished program, press RUN then NEWLINE. Enter your message. It will scroll continuously.

Warren Watson, Bellingham, WA

Step 1

Type with no line number:

```
POKE 16388,0  (N/L)
POKE 16389,124  (N/L)
NEW  (N/L)
```

This sets RAMTOP to 31744 because:

```
32768-1024=31744
31744-256*INT(31744/256)=0
INT(31744/256)=124
```

Step 2

Enter these two lines:

```
  1 REM AA...(117 As)...A
 10 LET A=31744
```

Now type:

```
POKE 16419,10  (N/L)
```

From now on, avoid listing line 10.

Step 3

Enter the following program and type GOTO 20 (N/L). Then enter the code in listing 1 (read horizontally, from left to right).

```
 20 LET B=0
 30 FOR I=16514 TO 16622
 40 INPUT A
 50 POKE I,A
 60 SCROLL
 70 PRINT I,PEEK I
 80 NEXT I
 90 FOR I=16514 TO 16622
100 LET B=B+PEEK I
110 NEXT I
120 SCROLL
130 PRINT "CHECKSUM= ";B
```

Listing 1

```
 33    0  124   94   35   62   12
187   40   29  229   22    0    6
  3  203   35  203   18   16  250
 33    0   30   25   17  239   64
  1    8    0  237  176  205  170
 64  225   24  220  201    6    8
197   42   12   64    1  197    0
  9  235   33  239   64    6    8
203    6  235   56    4   54    0
 24    2   54   23  197    1   33
  0    9  235   35  193   16  235
205  214   64  193   16  215  201
 42   12   64   35   62   22    1
 31    0   84   93   35  237  176
 43   54    0   35   35   61  254
  0   32  238  201
```

The checksum should equal 9231. Repeat step 3 if not equal to 9231.

Step 4

Finally, enter this driver program. Delete lines 100-130. Note line 1 now looks like this:

```
  1 REM 5 ???Y£■C1 FAST - ■ACS
 7ACS >( IF 5 2;) LOAD RND■ ■ GO
SUB ■LN ■RND LPRINT ■)=TAN ■ VAL
 £RND■ VAL  ■ FOR 5 LOAD RND■■AC
S ■ FOR S■0 ■0≠VAL "5 ■ FOR 7AT
 ( FOR LN CHR$ RNDAT (NOT TAN £
RND7Y-■3 ??7 GOSUB ■F0 77X RETUR
N  4 INPUT TAN  Y■■■■■■■
  10 LET A=31744
  20 PRINT AT 10,18;"ENTER MESSA
GE"
  30 INPUT A$
  40 FOR I=1 TO LEN A$
  50 POKE (A-1)+I,CODE (A$(I TO
I))
  60 NEXT I
  70 POKE (A-1)+I,12
  80 LET L=USR 16514
  90 GOTO 80
SYNTACTIC SUM:  19758. 8K
```

Both listing 2 and 3 can be loaded anywhere in RAM. You can scroll from 1 to 22 lines. Just POKE the 9th location in listing 2 or the 6th location in listing 3 with any value 1-22. Call the routines using the USR function.

Here's a loader program:

```
 10 LET A=(location of code)
 20 FOR I=1 TO (32 listing 2 or 25
for listing 3)
 30 INPUT B
 40 POKE (A-1)+I,B
 50 SCROLL
 60 PRINT (A-1)+I,PEEK (A-1)+I
 70 NEXT I
```

Listing 2 (32 bytes)

```
 42   12   64    1   32    0    9
 62   22    3  197   84   93  229
 43    1   31    0  237  184   35
 54    0  225  193    9   61  254
  0   32  235  210
```

Listing 3 (25 bytes)

```
 42   12   64   35   62   22    1
 31    0   84   93   35  237  176
 43   54    0   35   35   61  254
  0   32  238  201
```

FIFTEEN PUZZLE--4K/2K

This program was rewritten from one appearing in Kilobaud Feb. 1981 by William Colsher. The game was invented by Sam Loyd in 1878 and consists of 15 numbered blocks and 1 space in a 4x4 matrix.

The object of the game is to arrange the blocks in order:

```
 1   2   3   4
 5   6   7   8
 9  10  11  12
13  14  15  --
```

Sounds easy--but it's not. Not all of the 20,922,789,888,000 possible starting combinations are solvable, so the program checks for this. If your starting combination is not, the computer resets before displaying your puzzle. This is why it takes a few seconds before anything displays. The program also checks for illegal moves on each entry.

With each entry, the computer checks for a win. When you win, it congratulates you and tells you how many moves you took. If you get frustrated, enter 0 (zero) and the game ends. The program uses a little over 1K of memory.

Bill Eckel, Omaha, NE

```
  3 DIM B(8)
  5 DIM A(16)
 10 GO SUB 300
 15 LET M=0
 20 FOR I=1 TO 16
 30 LET A(I)=0
 40 NEXT I
 50 FOR I=1 TO 16
 60 LET R=RND(16)
 70 IF NOT A(R)=0 THEN GO TO 60
 80 LET A(R)=I
 90 NEXT I
100 GO SUB 500
110 IF F=1 THEN GO TO 20
120 GO SUB 600
130 PRINT
140 PRINT "YOUR MOVE"
150 INPUT X
152 LET C=X
155 IF X=0 THEN STOP
160 GO SUB 400
170 GO SUB 700
180 IF NOT F=0 THEN GO TO 210
185 PRINT
190 PRINT C;" IS AN ILLEGAL MOV
E, RE-ENTER"
200 GO TO 150
210 LET A(X+F)=A(X)
220 LET A(X)=16
230 GO TO 800
240 LET M=M+1
250 GO TO 120
300 LET B(1)=2
310 LET B(2)=4
320 LET B(3)=5
```


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```
 330 LET B(4)=7
 340 LET B(5)=10
 350 LET B(6)=12
 360 LET B(7)=13
 370 LET B(8)=15
 380 RETURN
 390 REM CONVERT NO. TO LOCATION
 IN ARRAY
 400 FOR I=1 TO 16
 410 IF A(I)=X THEN GO TO 430
 420 NEXT I
 430 LET X=I
 440 RETURN
 450 REM VERIFY SOLUTION POSSIBL
E
 500 LET F=1
 510 LET S=0
 520 FOR I=1 TO 15
 530 FOR J=I+1 TO 16
 540 IF A(I)>A(J) THEN LET S=S+1
 550 NEXT J
 560 NEXT I
 565 FOR I=1 TO 8
 570 IF A(B(I))=16 THEN LET S=S+
1
 575 NEXT I
 585 IF (S/2)*2=S THEN LET F=0
 590 RETURN
 595 REM DISPLAY GAME BOARD
 600 CLS
 610 PRINT ,"FIFTEEN PUZZLE"
 615 PRINT
 620 LET I=1
 625 PRINT ,
 630 FOR Y=1 TO 4
 632 IF A(I)<10 THEN PRINT " ";
 635 IF A(I)=16 THEN PRINT "  ";
 640 IF NOT A(I)=16 THEN PRINT A
 I);
 645 PRINT " ";
 650 LET I=I+1
 655 NEXT Y
 660 PRINT
 662 PRINT
 665 IF I=17 THEN RETURN
 670 GO TO 625
 680 REM CHECK FOR LEGAL MOVE
 700 LET F=0
 710 IF X+1>16 THEN GO TO 725
 720 IF A(X+1)=16 THEN LET F=1
 725 IF X-1<0 OR X-1=0 THEN GO T
O 735
 730 IF A(X-1)=16 THEN LET F=-1
 735 IF X+4>16 THEN GO TO 745
 740 IF A(X+4)=16 THEN LET F=4
 745 IF X-4<0 OR X-4=0 THEN GO
TO 760
 750 IF A(X-4)=16 THEN LET F=-4
 760 RETURN
 770 REM CHECK FOR WIN
 800 FOR I=1 TO 16
 810 IF NOT A(I)=I THEN GO TO 24
0
 820 NEXT I
 830 GO SUB 600
 840 PRINT
 850 PRINT
 860 PRINT "YOU WON IN ONLY ";M;
" MOVES"
 870 STOP
```

Syntactic Sum: -20020, 4K

SPEED UP PRINT LINES--ZX81

You can make PRINT statements execute faster. Enter the following test and run in SLOW mode:

```
  10 FOR N=1 TO 50
  20 SCROLL
  30 PRINT "THIS IS A TEST OF PR
INTING SPEED"
  40 NEXT N
```

Run time=17 sec. Add this line:

```
  25 PRINT AT 21,31;AT 21,0;
```

Run time=9 sec.

I think the reason it prints so much faster the second time is that when you SCROLL you upset the padded out line 21. Adding line 25 pads it back out. (This is just a guess.)

In a long inventory program I wrote the ZX81 took about a second to print 2 characters and a very long time to print the entire line.

Try this:

```
   1 DIM A(3000)
  10 FOR N=1 TO 10
  20 SCROLL
  30 PRINT "THIS IS A TEST OF PR
INTING SPEED"
  40 NEXT N
```

Now run and time. Run time=3 min, 29 sec. Add line 25:

```
  25 PRINT AT 21,31;AT 21,0;
```

Run time=27 sec.

I suggest adding this line right after every SCROLL.

John Oliger, Indianapolis, IN

Lack of ZX81 memory giving you headaches..?

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The growth of interest in computer use caused by the introduction of the Sinclair ZX81 has made new and exciting demands on the ingenuity of electronic engineers. At Memotech we have focused our attention on the design of an inexpensive, reliable memory extension.

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SIMULATING INTEGER ARRAYS

Many BASICs use integer variables to save memory. The ZX81 has only floating point variables, but you can simulate integer arrays with small values using PEEK and POKE. This technique only stores values between 0 and 255, but saves lots of memory with large arrays not requiring large values.

To use an integer array, first reserve space for it. Put a REM line as the first program line, followed by spaces equal to the size of the array. You can also reserve space by changing the ZX81 system variable RAMTOP (see manual, chaps. 26-28). This two-byte value at 16388 and 16389 normally holds 17407 with 1K RAM. To reserve X bytes at the top of RAM, enter:

```
POKE 16388,INT((17407-X)/256)
POKE 16389,X-INT((17407-X)/256)
NEW or CLEAR
```

The first byte of the array will be at location 17407-X. If you use a REM, it must be the first line and the array starts at 16514.

You can access any position in a one-dimensional array by PEEKing or POKEing at an address = (the starting address + the desired position - 1). For example, to print location I in array U, you normally have:

```
 100 PRINT U(I)
```

Use the following instead:

```
   1 REM .............
  10 LET U=16513
 100 PRINT PEEK(U+I)
```

Note that U is defined as array start - 1 to save a calculation each time the array is accessed.

Two-dimensional arrays are equally simple. For example, to print location I,J in array V you normally have:

```
 100 PRINT V(I,J)
```

Use the following instead:

```
   1 REM ..............
  10 LET V=16505
 100 PRINT PEEK(V+8*I+J)
```

This example assumes that the I dimension of the array is 8. So V becomes 16514 - 8 (the first dimension of the array) - 1 and I is multiplied by 8 each time the array is PEEKed or POKEd. Any other value can be used as well.

To show how much space this method can save, say the array V in the last example was set up by DIM V(8,8). This ZX81 floating point array takes up 8x8x5, or 320 bytes of memory for data since each value is stored as 5 bytes. By setting up your own array you need only 8x8 or 64 bytes--a significant savings!

You also save space by setting a variable equal to the array's starting address as in our examples. The ZX81 uses 11 bytes to store the starting address in each PEEK or POKE where it's used (1 byte for each of 5 digits in the number, plus a special character, plus 5 digits for the floating point value). But a variable name only takes 1 byte to store.

Nels Anderson, Chestnut Hill, MA

HARDWARE REVIEW

Products:	Quicksilva Hi-Res Graphics Controller, Connector & Motherboard
From:	Quicksilva, 95 Upper Brownhill Rd., Maybush, Southhampton, Hants UK
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If you're frustrated by the somewhat limited graphics capabilities of your ZX81, there may be an answer. A ZX81 hi-res (high resolution) graphics board is now available. It provides 256x192 pixels and is programmed with 14 new BASIC commands. The board is about 5 1/2" x 3 1/4" and contains 6K RAM. Also on board is 2K ROM containing the software for system operation.

You need at least 4K RAM to successfully operate this device. You also need the QS connector and motherboard to accomodate both the hi-res board and external RAM.

The connector and motherboard seems to be a reliable expansion method. The motherboard lets you use up to two QS add-on boards plus external memory. On board is a five-volt regulator which drives all external boards. The connector is made up of two 46-pin edge connectors soldered back to back and lets you use one add-on board or the motherboard. The only problem I had was due to the fact that the add-on boards stand vertically in their connectors with no other support. If you bump or nudge a board a little too hard, the system crashes.

Operating the hi-res board is simple enough. A USR routine from the ROM tests the system for correct operation. A test pattern appears on the screen with an OK message.

Fourteen new BASIC commands create hi-resolution displays, such as WHITE (draws white on black), BLACK (black on white), BOX x y (draws a box from cursor to coordinate x y) and PRINT A$ (prints variable A$ at cursor point). You insert these new commands in REM statements. Multi-statement lines are allowed and all commands can be shortened to the first two letters. The REM statement must be preceded by a single USR call. Thus, each time you execute a hi-res command you need two BASIC lines.

Hi-res and normal displays can't be combined on the screen, limiting the device's applications. Programming a game or simulation in the hi-res mode would be difficult. But you can switch between normal and hi-res modes fairly easily by pressing a button on the board or using a POKE statement.

The instruction manual is easy to understand and accurate. Several example programs are included. The manual also gives information on machine language programming.

I had only one problem getting the device to operate. The standard ZX81 power supply would not operate the board correctly, although an extra ZX81 supply did. Also, to take full advantage of the hi-res display, I advise you to use a video monitor. A TV receiver does not have the bandwidth to separate closely spaced lines.

Summing up, the QS hi-res board is a very expensive device apparently limited in its applications. I feel that the end result to the average user does not justify the expense of this high-priced board. I am certain, however, that some applications of this device would justify the expense.

Lance M. Ward, Lansing, MI

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SOFTWARE REVIEW

Program: ZXAS-ZXDB
Price: ZXAS or ZXDB, $9.95 each, $12.95 each in Canada
From: Gladstone Electronics, 901 Fuhrmann Blvd., Buffalo, NY 14203. Written by Bug-Byte, Liverpool, UK

While constructing an interface between the TI Speak & Spell and my upgraded MicroAce, I found I needed to write a machine language driver because of the voice synthesizer timing requirements. To make this task less painful, I ordered the ZXAS machine code assembler and ZXDB disassembler-debugger software from Gladstone Electronics. When the cassettes, sans documentation, arrived (2 months late because the order was lost), I was unable to load the programs successfully.

The recordings are noisy and the output level varies causing the computer to see invalid logic levels. Successful loading required the use of an oscilloscope and rebiasing the computer input lines. The 1K pull down resistor (ZX80 R1) was replaced with a 2K variable and set to give +0.6V on pin 2 of the 74LS365 (ZX80 IC10), and the tape recorder volume set full up (about +5V peak). Another call to Gladstone brought 8 pages of documentation. These xeroxed 8 1/2" x 11" sheets briefly describe program use, but contain no listing for loading verification.

Copywritten in 1981 by Bug-Byte, both ZXAS and ZXDB are extremely powerful tools for assembly language programmers. Both may concurrently reside in memory, with ZXAS occupying the top 5K of RAM and ZXDB the lower 4K.

ZXAS is used by writing standard Z80 assembly language mnemonics in a series of REM statements. Next, you input the beginning address of where the code is to reside. The 2-pass assembler then assembles the code into machine language, loads it into RAM and displays line number, memory address, opcode and mnemonics for each instruction. An error message is also provided for syntax errors. The program allows the use of up to 256 labels for use in jump and call instructions and as "variables." Comments are also supported. Numerical data may be in either decimal or hexadecimal.

ZXDB offers the use of ten commands by pressing a single key. You may fill, move and compare blocks of memory, or search for an input string of characters. Searching for opcodes, though, may require masking certain bits or risking a crash. Bit masking is supported. Memory may be viewed as characters, in hex, or it may be disassembled into mnemonics (many are nonstandard 8080 types). A really exciting feature of ZXDB is its "set breakpoint and execute program" command. This command allows you to single step through your user program and display the contents of the AF, BC, DE, HL, PC, SP, IX, and IY (but not the I & R) registers as well as the contents of memory pointed to by the register. The mnemonics of the current and next instructions, in addition to an 8-byte memory window are also displayed. This mode offers ten more commands; one of which allows you to directly alter register contents. All numerical input is in hexadecimal.

These two very useful programs are certainly worth the investment if you indulge in the arcane art of machine code programming.
P.S. My MicroAce now has a vocabulary in excess of 400 words.

Larry G. Dighera, Santa Ana, CA

Our copies of ZXAS and ZXDB are from Bug-Byte. ZXAS loaded fine, but ZXDB wouldn't load at all. Gladstone said they spot test all tapes. If you get one that won't load, they'll replace it free.--AZ

DICE ROLL PROGRAM--8K/1-2K

This program randomly chooses two digits, 1-6, and displays them in a dice format. Version 1 runs in RAM; version 2 requires more. For both versions, begin with RUN (NL) and stop with BREAK.

The program is self-contained and requires no input during operation. When dice points are shown, the image on the screen remains for about 16.5 seconds. To roll the next set before this time is up, simply press any key. Otherwise, after the pause is completed, the dice will roll automatically.

In version 1, the 1K operation uses virtually the entire memory. Change line 10 to STEP -2.5 and the program will frequently stop with code 4/.

Version 2 gives more elegant dice if you have more memory. To save a little bit more, delete lines 35 and 45 and change:

```
  40 PLOT M+7+26*B,13+19*C
  50 PLOT 19*C+7+26*B,M+13
```

David R. Rowland, Montclair, NJ

Version 1

```
   5 RAND
  10 FOR M=31 TO 13 STEP -2.6
  20 PLOT 7,M
  30 PLOT 26,M
  40 PLOT 33,M
  50 PLOT 52,M
  60 NEXT M
  70 FOR B=0 TO 13 STEP 13
  80 LET Y=INT (RND*6)+1
  90 IF Y=1 OR Y=3 OR Y=5 THEN P
RINT AT 10,8+B;CHR$ 128
 100 IF Y<>1 THEN PRINT AT 7,5+B
;CHR$ 128;AT 13,11+B;CHR$ 128
 110 IF Y=6 THEN PRINT AT 10,5+B
;CHR$ 128;AT 10,11+B;CHR$ 128
 120 IF Y>=4 THEN PRINT AT 7,11+
B;CHR$ 128;AT 13,5+B;CHR$ 128
 130 NEXT B
 140 PAUSE 1000
 150 CLS
 160 GOTO 10
SYNTACTIC SUM:   31576, 8K
```

Version 2

Version 2 is identical to Version 1 with the changes next column:

```
   5 RAND
  10 FOR C=0 TO 1
  20 FOR B=0 TO 1
  30 FOR M=0 TO 19
  35 LET Z=19*C
  40 LET A=26*B+7
  45 PLOT M+A,13+Z
  50 PLOT Z+A,13+M
  55 NEXT M
  60 NEXT B
  65 NEXT C
SYNTACTIC SUM:   34333, 8K
```

USERS' GROUPS: To list your group, call or drop us a line and we'll send interested people. To locate a group in your area, call or write (please include a SASE).--AZ

Seattle, WA--Sinclair Program Exchange. Contact Marty Prather, 17058 28th NE, Seattle, WA 98155.

Pacifica, CA--Contact George Mockridge, 263 Gateway #107, Pacifica, CA 94044.

Pomona, CA--Perkin Elmer Users Group. Contact Rein Smith, 8333 Pulamo, Alta Loma, CA 91701.

Houston, TX--Contact Fayne Sisco at 713/479-4571 after 6 PM.

Idaho Falls, ID--Contact I.W. (Wil) Underwood, P.O. Box 1195, Idaho Falls, ID 83401, 208/524-4635.

Prince County, MD--Amateur radio group. Contact Jim Wallace, 5448 Tilden Rd., Bladensburg, MD 20710, 301/699-8712.

Tampa Bay, FL--SAM-BAM Users Group. Contact Mel Routt, P.O. Box 596, Safety Harbor, FL 33572.

Merritt Island, FL--Space Coast Microcomputer Club. Contact Bruce Hosken, 70 Darwin Ave., Merritt Island, FL 32952, 452-3015.

These people would like to contact other Sinclair users in their area:

Pierre Houle, Laval, Quebec, 514/668-1965.

A. O'Connor, Port Moody, British Columbia, 604/461-6420.

DEAR EDITOR:

I just started with my ZX81 and would like to know what other readers consider the best cassette recorder-player in the market for storage and loading a ZX81.

Jose S. Cabrera, Levittown, NY

ZX80/81s work with most recorders. We use Radio Shack CTR-80A (about $60) with no problems. You can use regular or microcassettes.--AZ

In the Dec.81 issue p.3 was a circuit for an Improved Video Monitor Driver for the ZX80. I have a ZX81 and the solution does not apply because the problem does not exist.

I am driving a Panasonic 9" monitor (cat. #WV-5300) directly from the 1V P-P composite video that feeds the RF modulator in my ZX81. I switch the input termination on the TV monitor to Hi-Z and get a fabulous picture. Because the driving point impedance is 390 Ohms (R31) and the ZX81 case is shielded, I did not use coax but got away nicely with 22 gauge twisted pair wire. I installed a BNC connector in my ZX81 case for convenience but a twisted "pigtail" would work OK too.

The hookup is simplicity itself and does not interfere with the TV or saving programs on tape.

Samuel J. Levine, Galveston, TX

I own a Sinclair ZX81 computer and am dissatisfied with its operation. I experience frequent, unpredictable system failure due to the power jack plug connection, keyboard depressions and the edge connector contact for the 16K RAM. The system failures result in loss of time and effort in reentering and rerunning programs. My ZX81 sits on a shelf instead of being used because of its error-prone operation.

I would like to hear from other ZX81 owners who are experiencing these same failures and are interested in sending a group message to Sinclair requesting a fix. Contact me (use a postcard if you like) at POB 50301, Palo Alto, CA 94303. I will respond through SYNTAX.

Donald F. Shank, Palo Alto, CA

I have experienced glitches with my ZX81 caused by overheating of the voltage regulator. Voltage measured at the tip of the power supply was 14.5 with no load. Voltage under load dropped to 12.5. I assume the difference under load between the 9.75V required and the 12.5V available powers the optional memory and printer. Since this excess voltage must be consumed somehow, I also assume this is the function of the voltage regulator, converting this surplus to heat and dissipating it through the heat sink. It appears the standard heat sink cannot dissipate this excess.

I noted all the solutions in SYNTAX, such as painting the heat sink black, cutting the case for improved ventilation, and remote mounting of the voltage regulator. None of these seem the best solution. Here's what solved my problem:

Since the area under the keyboard is empty except for the corner where the standard heat sink is, I had a machine shop make a new heat sink that fills the entire area. The new heat sink is aluminum 50% thicker than the original, is 5 inches long and bolts in the same way. I have run my ZX81 for 20 straight hours with no glitches.

This solution keeps the ZX81's stock appearance and function. I can provide this part. If you're interested, please send a stamped self-addressed envelope .

Blase Sahzone Jr., 289 Baxter Lane,
Milford, CT 06460

Recently I purchased a keyboard salvaged from a junked keypunch machine, intent on interfacing it with my ZX81. Although the purchase price was cheap ($15), the cost in time has been enormous. So far I've spent 7 hours on it and am yet another hour from completion. I urge your readers to spend those few extra dollars and buy a keyboard that is made for hobbyists or a specially adapted one from LJH, A&P, Kopac or others. It will be well worth the investment.

Jonathon E. Hodges

I was having much trouble with my ZX81 (loading, vertical bars, etc.). I removed the lower half of the case, took all the short screws and mounted the PCB to the upper half rigidly. Then I put the lower half back with just the 2 short screws under the edge at the keyboard. The unit works fine--no picture tears, vertical bars or lost programs.

Robert H. Adams, Westlawn, PA

Syntactic Sum routines must be run in FAST mode, otherwise the system crashes. The crashes are probably caused by the use of the ix register, which is also used for the display in SLOW mode.

After a delay of 4 months, my Sinclair 16K RAM pack arrived. Included was an additional power supply with the same specs as the one supplied with my ZX81. Were earlier machines supplied with inadequate supplies? Was the inclusion a mistake? Should I send the supply back to Sinclair for a credit?

Alfred Spencer, Framingham, MA

ZX80S were supplied with 500mA supplies initially, so Sinclair shipped heavier supplies with RAM packs. Now that most machines are ZX81s equipped with 650mA supplies, Sinclair no longer routinely sends these with RAMs. You did not pay extra for the supply, so Sinclair offers no refund. They will gladly accept the supply, however.

If you have a 500mA ZX80 and got no larger supply with your RAM, copy the information from the back of your supply. Mail it to 1 Sinclair Plaza, Nashua, NH. They will send you a 650mA supply.--KO

I understand there is a procedure for re-wiring a TV so it becomes a monitor. I have been using a little $70 TV--can it be adapted?

Bruce Bowes, Hopewell Junction, NY

This inexpensive procedure is in Radio-Electronics, Jan.81. David Cartier coupled a computer to his B&W TV with digital optoisolators. He says the circuit is not critical about parts-replacement or wiring. It uses 2 power supplies (1 in the TV); all plans in the article.--AZ

MORE 16K RAM SOLUTIONS

Herb Sturges of Orinda, CA, had problems in his Sinclair 16k RAM. Two leads in the internal ribbon connector were cut during assembly. Because the plastic ribbon holds them, they sometimes touch, giving sporadic function. You can see cuts in the board nearby with a magnifier. Return your RAM or replace the ribbon connector if your leads are cut.

Also, 1 of the 2 grounding straps was bent so it grounded the +5 and +9 supplies when the case was squeezed (as when you plug it in). Solution: Bend it back up.

LOADING REGISTERS WITH DATA

(This is part 4 of a series on machine code programming. See also past articles, starting Jan.82--AZ)

We've seen that the ZX80/81 uses registers to hold numbers. But how do you put the numbers into the registers?

There are only two ways, both using a LOAD command, abbreviated LD in machine code. The first way is to specify the register to load the number into and then the number itself:

```
  LD B,6
```

Read this as "Load register B with the number 6." (Always write the destination first, then what goes there.) The second way is to specify the register and then where the number to load is located in memory:

```
 LD A,(HL)
```

Read this as "Load register A with the number in the register pair HL." The parentheses indicate that you want the contents of that pair.

A simple program iteration-counter could "flow" like this:

```
  LD A,(nn)
  INC A
  LD (nn),A
```

where nn is the address of the count. The first statement puts the present count (held at address nn) into register A. INC A (increment A) adds 1 to the count. The last statement puts the new count back into storage at nn. The two load instructions are very useful because none of the other registers is affected.

To work with numbers greater than 255 (the largest number you can represent in one byte), at least one register pair (preferably HL) must be loaded with a storage-address "pair" or the number. You must use two register pairs if both numbers are greater than 255, as in this example:

```
ADDRESS DECIMAL=MNEMONIC COMMENT
16427     232    (data)   :232+(3*
                           256)=1000
16428     3      (data)
  xx1     42     LD HL,(nn) :get
                            data (1000)
  xx2     43     n        :43+(64*256)
                           =16427
  xx3     64     n        :HL loaded
                           w/ 2 addr.
  xx4     1      LD BC,nn :nn=data
  xx5     194    (data)   :194+(1*256)
                           =450
  xx6     1      (data)
  xx7     9      ADD HL,BC :add 1000
                           & 450
  xx8     34     LD (nn),HL :HL=old
                            HL+BC
  xx9     43     n         :put result
      back into storage addresses
```

Let's take a closer look at ADD HL,BC:

```
L232 + C194 = L426 ≡ L170
H  3 + B  1 = H  4 ≡ H  5
```

where ≡ indicates that the carry is added to H.

All loading instructions are basically the same. Just remember that (nn) means "the contents of nn," n is immediate data (a number) less than 256, and for data greater than 255 nn is held in an address-pair.

Next month: Register to register

Jon Bobst, Zeta Software, P.O. Box 3522, Greenville, SC 29608-3522

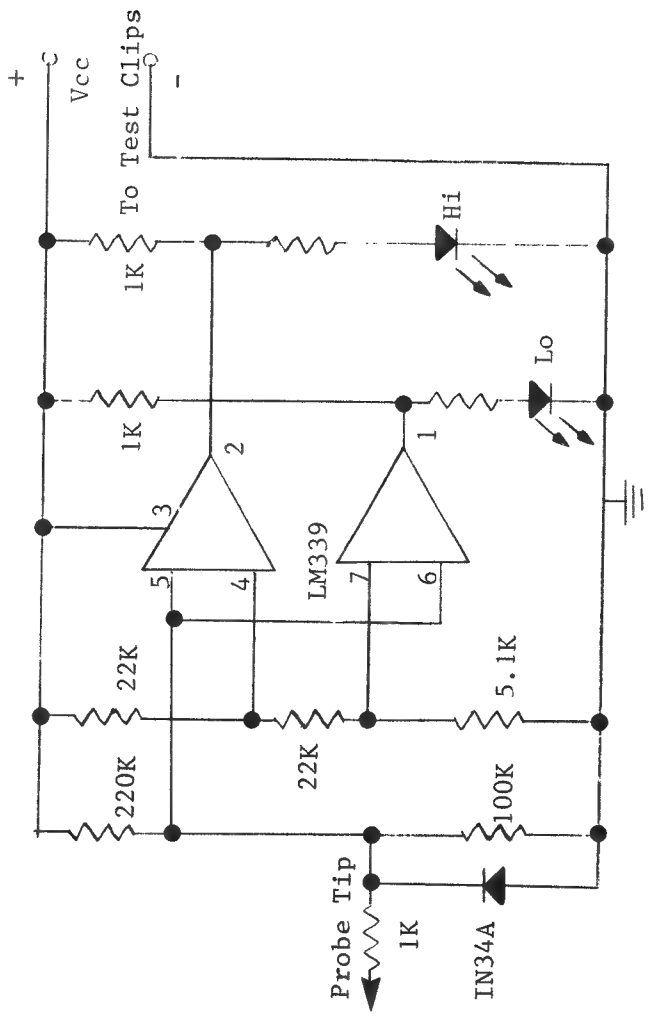
DIGITAL LOGIC PROBE

Probably the handiest test instrument on a digital workbench is a logic probe. You can build the logic probe described here for less than $10.

This device uses one-half of a LM-339 quad comparator. The reference voltages are set by the resistor divider network at pins 4 and 7. In this case the threshold levels are "Lo" 12% Vcc; "Hi" 50% Vcc. One comparator detects high logic levels while the other detects low logic levels. The two LEDs indicate the logic status. Both LEDs being lit at the same time indicates a pulse train. Since this logic probe uses the LM-339, it is compatible with either CMOS or TTL logic levels.

To enclose this device, use plastic tubing--this is the easiest way to ensure proper insulation. A 6-32x1 1/2" machine screw with 1/2" of the threaded end ground to a point makes a good probe tip. Connect the circuit power leads to color-coded test clips.

Lance M. Ward, Lansing, MI



ZX81 SOFTWARE REVIEW

*Moi OTHELLO, by Martin Brennan, $19 US from Mine of Information Ltd., 1 Francis Ave., St. Albans, UK AL3 6BL
*THE FAST ONE, by John Campbell, $30 US from Campbell Systems, 15 Rous Rd., Buckhurst Hill, Essex, UK IG9 6BL

Both programs reviewed here are excellently produced. Moi OTHELLO is an advanced version of the popular board game. THE FAST ONE is a business-oriented general filing and reporting program.

Between them, they show very nicely how a 16K ZX81 can manage both advanced logical algorithms and advanced record handling.

*Moi-OTHELLO

This game comes in an attractive box containing the cassette tape and a 16-page instruction booklet. Novices should read parts of the booklet about the techniques of playing Othello, but experts may be more interested in the hex dump of the 3K of machine code.

The program's main menu allows you all the normal features of selecting the game level, retracting a move, changing sides, starting a new game, and returning to BASIC.

Levels 1-4 are simple to beat once you develop some skill, but these levels are fun to play as the computer's response time is always less than 5 seconds. However, the computer is not very clever at all.

Level 5 is perhaps par for the course. This level responds in about 30 seconds and the computer is embarrassingly astute. No slip on your part results in anything but dismal failure as the computer sweeps forward, mopping up all vestiges of resistance.

Levels 6-9 are for experts. Although the computer plays a high-quality game, response times are long (L6=1 min., L7=2 min., L8=5+ min., L9=?). I can beat this game at level 6, but I don't know yet how consistently.

Overall, this is a "proper" Othello and no doubt will be very popular. Whether it beats Reversal (TM) or Quicksilva's Reversi (TM) has yet to be tested. Any offers?

*THE FAST ONE

This program comes on cassette accompanied by a detailed 10-page instruction leaflet.

Initially, this program will overwhelm you as it is daunting in the extreme. But John Campbell skillfully introduces his program by supplying both the master program and a fine demo program.

The Fast One (TFO) is a general filing and reporting system. The master program holds an empty file that you fill with your own data, such as names and addresses, past successes of favorite sports figures, or recipes. So initially the master program does next to nothing, but the demonstration program performs impressively.

TFO's essential parts involve:

1. Filing your data as a series of records.
2. Formatting your reports
3. Selecting which records to report.
4. Making the actual report on the TV screen or printer.

In the demo the first 2 steps are done, giving 11 records and 3 report formats. You can choose which records are to be reported. For example, you can select from the file of 11 staff records only those members who ARE over 40, DO earn over £6000, and DO NOT work in administration. Results can be displayed and printed in file-order or in 2 different alphabetically ordered displays.

The strong point of this program is its immense versatility. The program is mainly menu driven and the number of different menus is itself amazing. The main menu lets you add, update or delete records each holding up to 36 fields (items) of up to 32 characters. Before you enter a record, you must define the items it will hold, such as NAME as the name and SALARY as the salary.

Entered records are inaccessible until you define a report format. To define a format, you specify the format of the whole screen, then how the records will be sequenced. Then you can reproduce records from your file and select items to display.

This program is fantastic in its elegance, sheer speed and ease of use. It is a pleasure to use seriously, as well as being an object of study. It embodies many aspects of modern file handling.

TFO is mainly in machine code, using about 5K of RAM when the file is empty. The file is managed dynamically, so only the file and the master program are ever saved on tape. The sheer speed with which records can be manipulated is incredible. For example, the ZX81 tallies spare bytes as a main menu option. It clocks them one by one, from 00000 to 11700 in 2 seconds.

I strongly recommend this program. It is the most interesting one I've seen yet for the ZX81.

Ian Logan, Skellingthorpe, UK

Ian added that ordering from England was easy and personal US checks are quite acceptable. Some have reported that clearing time for checks is quite long in the UK. I suggest sending money orders.--AZ

SOFTWARE

GAMES PACKS

1 for 1K ZX81 & 8K ROM ZX80. Eight fantastic programs for the unexpanded ZX81, including DIGICLOCK, 9-LIVES, REACTION TEST, GOBBLER and PATTERNS.
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Fantastic new adventure game for 16K (or greater) ZX81. You have just become 129th ruler of Ritimba with a single goal in mind: take full advantage of the situation for your own good. You have to deal with a handful of factions: unruly army, downtrodden peasants — but you have the secret police on your side.
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ZX CHESS

(for ZX81 and 8K/ZX80 both with 16K RAM)

A challenging chess programme, written in machine language, designed to operate in the ZX81 fast mode. ZX Chess allows you to select from 6 levels of play, choose either black or white, and enables castling and en passant moves. Unique "self-running" feature: you start the tape and when the chess board appears on the screen, start your game.
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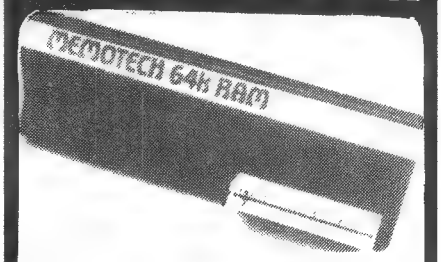
STAR TREK

The classic computer game in which you trek across the galaxy in search of Klingons to zap with your phasers and photon torpedoes. You have long and short range scanners to help you find them, Starbases to refuel your ship at and, of course, various witty comments from the crew. 16K.
$9.95 ($12.95 in Canada)

64K For Sinclair ZX81 $159



Memotech 64K Memopak

The Memopak is a 64K RAM pack which extends the memory of the ZX81 by a further 56K. Designed to be in the price range expected by Sinclair owners. Plugs directly into the back of the ZX81 and does not inhibit the use of the printer or other add-on boards. There is no need for additional power supply or cables. The Memopack together with the ZX81 gives a full 64K, which is neither switched nor paged, and is directly addressable. The unit is user transparent, and accepts such basic commands such as 10DIM A(9000).
With the Memopak extension the ZX81 is transformed into a powerful computer, suitable for business, leisure and educational use, at a fraction of the cost of comparable systems.

VU-CALC

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A ten page information display system for the 16K ZX81. Can display both text and graphics in any sequence with variable speed. Many applications including shop window displays, educations, animation, etc.
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BOOKS

Not Only 30 Programs for the Sinclair ZX81: 1K-
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A complete beginner's guide to the computer's own language—Z80 machine language. Machine language programs enable you to save on memory and typically give you programs than run 10-30 times faster than BASIC programs.
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ZX81 ROM Disassembly
Part A. Covers ROM locations from 000H to OF54H and includes all functions except for routines used in floating point calculator. A must for the experienced programmer.
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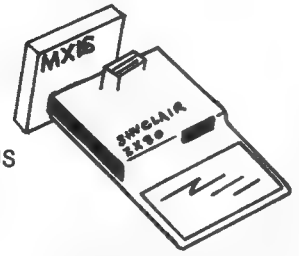

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SOFTWARE TIPS

To save multiple copies of your program, make these the last two program lines:

```
9998 SAVE "program name"
9999 GOTO 9998
```

Enter GOTO 9998 and your program will be saved many times. Hit BREAK to stop.

To run immediately after loading, add these last two lines:

```
9998 SAVE "program name"
9999 GOTO 1
```

This works only if you have no STOP statements. If a STOP statement is necessary, enter these lines:

```
9996 POKE (memory location of the
REM in line 9997),227
9997 REM
```

Change all STOP statements to GOTO 9996. This way your program won't have a STOP until after running. Make sure line 9997 has REM and type GOTO 9998 to save.

Mark Freitas, Chelsea, MI

READ-DATA-RESTORE SUBROUTINE

Most BASICs (but not ZX81 BASIC) have READ, DATA and RESTORE statements. Here's a way to accomplish their equivalent on your ZX81:

DATA information is entered as a string variable. For example, if you want the integers 123, 446, 78, 1, and 896, enter the string variable A$="123446078001896". Note that 78 is entered as 078 and 1 as 001 to keep the same number of digits as the other entries.

RESTORE is entered as a subroutine:

```
 100 LET N=1
 110 RETURN
```

The first time you want to use the data list, call this subroutine.

READ is entered as another subroutine:

```
 120 LET Z=(VAL(A$(N)))*100+VAL(
A$(N+1))*10+VAL(A$(N+2))
 130 LET N=N+3
 140 RETURN
```

Use the instruction following your GOSUB 120 instruction to set your desired variable equal to Z.

If the data list contains decimal data, enter the information in the string variable as integer digits and modify subroutine line 120 as follows:

```
 120 LET Z=(VAL (A$(N)))*10+VAL
(A$(N+1))+(VAL (A$(N+2)))*.1
```

To save an instruction, you could combine the two subroutines:

```
 100 LET N=1
 120 LET Z=(VAL (A$(N)))*100+VAL
(A$(N+1))*10+VAL (A$(N))
 130 LET N=N+1
 140 RETURN
```

Herbert A. Magnus, Cherry Hill, NJ

FIX FOR EXCESSIVE CHARGER RIPPLE

The symptoms are classic--a distorted section of the display moving vertically across your TV screen or even loss of vertical sync altogether--yet your ZX81 still executes commands properly. The condition tends to appear under

higher current loads, such as with the 16K RAM pack. If this has happened to your computer, it may be a problem with excessive ripple on the +5V.

The culprit is usually a weak and degraded charger which is no longer able to maintain sufficient voltage to the 5V regulator input.

Fortunately, there's an inexpensive alternative to buying a new charger or power supply. Just replace the existing 22MFD/16V cap (C3 on the schematic) with a Nichicon 220MFD/16V. The part is available from Radio Shack (cat. no. 272-956) and is totally compatible with the PC board. The additional filtering should clear up any 5V rippling problems.

Sam Porter, Boxboro, MA

RECHARACTERIZING--4K AND 8K

Here's a way to replace characters or keywords in lines or blocks of lines. Try this example for 4K ROM:

```
 10 PRINT A AND B
 20 PRINT B AND C
 30 PRINT C AND D
 40 PRINT D AND E
 50 STOP
 60 FOR S=16423 TO 16475
 70 IF PEEK(S)=224 THEN POKE (S
),(225)
 80 IF PEEK(S)=248 THEN STOP
 90 NEXT S
```

Enter these lines, then type GO TO 60, press NEWLINE. You'll get an error message. Press NL again and you'll see these program lines:

```
 10 PRINT A OR B
 20 PRINT B OR C
 30 PRINT C OR D
 40 PRINT D OR E
```

Daniel O'Connell, San Antonio, TX

S starts at the first address for program lines and checks each byte. When it finds a 224 (character code for AND, it replaces it with 225 (code for OR).

To do the same thing with an 8K ROM, change these lines:

```
 60 FOR S=16509 TO 16561.
 70 IF PEEK S=218 THEN POKE S,2
17
 80 IF PEEK S=227 THEN STOP
```

These changes substitute 8K addresses and character codes.

FLOWER PLOT--8K/1K

With spring approaching, here's a program to watch flowers grow on your 1K ZX81.

The basic formula is for an elipse: X=P*COS (Theta) and Y=Q* SIN (Theta). To form a flower, P & Q are replaced with R. When N is even, 2N petals will be generated; when N is odd, N petals will be generated. Try these values for N in line 10:

```
 N=8  Mayan Daisy
 N=99  Rose
 N=456  Chrysanthemum
 N=999  Surprise!
```

As in nature, these flowers take a while to come to full bloom.
Variables: N=number of petals
D=Delta P=controls flower diameter
I=increment T=Theta

William Wentz, Rio Rancho, NM

```
  5 REM FLOWER PLOT
 10 LET N=4
 20 LET D=2*PI/600
 30 LET P=20
 40 FOR I=0 TO 600
 50 LET T=D*I
 55 LET R=P*SIN (N*T)
 60 LET X=R*COS T+31
 70 LET Y=R*SIN T+21
 80 PLOT X,Y
 90 NEXT I
SYNTACTIC SUM:  10110, 8K
```

N=8

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